CEBAF Program Advisory Committee Nine
Extension and Update Cover Sheet

This update must be received by close of business on Thursday, December 1, 1994 at:

CEBAF
User Liaison Office, Mail Stop 12 B
12000 Jefferson Avenue
Newport News, VA 23606

Experiment: **Check Applicable Boxes:**

E - ☒ Extension ☐ Update ☐ Hall B Update

Contact Person

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Receipt Date: 12/14/94 PR 94-136

By: gp

THE UNIVERSITY OF SOUTH CAROLINA

Department of Physics and Astronomy

Columbia, SC 29208

December 9, 1994

PAC9
c/o User Liaison Office
CEBAF Center A204
12000 Jefferson Ave.
Newport News, Virginia 23606

Dear PAC9,

By this letter we are requesting an extension of the deferral of proposal **PR-89-001** until the next PAC. A copy of the PAC4 report is attached to this letter. In order to address the requests of PAC4 for more modeling and simulation , two U.S.C. graduate students (Michel Guidal and Etienne Burtin) have been resident at CEBAF and have developed the GEANT program for CLAS. This program is now the standard simulation program for CLAS. Recently (Nov. '94), Soyeur and Friman have calculated $\frac{d\sigma}{dt}$ for coherent photoproduction in the non-diffractive region below 4 GeV. In addition they found a significant error in the 6-fold differential cross section $\frac{d^6\sigma}{dE_+ dE_- d\Omega_+ d\Omega_-}$ of Alvensleben et al. (Phys. Rev. Letters **27**, 444 (1971)) which we had been using to calculate the vector meson photoproduction and decay into two leptons. We are now using the corrected equations and the Soyeur-Friman $\frac{d\sigma}{dt}$ to study the effects of different production phases and the energy dependence of the cross sections. These calculations and up-to-date simulations of CLAS will be ready by PAC10.

Anticipating some questions, we submit the following information. The title of this proposal is similar to proposal **PR-94-002**, "Photoproduction of Vector Mesons Off Nuclei". They are quite different experiments although they both study nuclear mass dependent effects of vector meson photoproduction by detecting e^+e^- pairs. Proposal **89-001** requests the measurement of e^+e^- pairs at forward angles to observe the interference of the pairs from the decay of vector mesons **coherently** produced in nuclei with those from the QED Bethe-Heitler process. Such a measurement allows the determination of the photoproduction phases. These phases are in principle sensitive to the nuclear environment in

which the vector mesons are produced. This experiment has the target moved upstream by approximately 3 m to enhance the forward angle acceptance. Proposal **94-002** requests the measurement of e^+e^- pairs from the decay of vector mesons **incoherently** produced in nuclei in order to observe any medium modifications of the mass and/or width of the vector mesons.

One final administrative note, the cospokesmen for proposal **89-001** are now David Heddle and Barry Preedom.

Sincerely.

Barry M. Preedom
Professor

Proposal: PR-89-001

Spokespersons: B. Preedom and G. Blanpied

Nuclear Mass Dependence of Vector Meson Interactions Using The Photoproduction of Lepton Pairs

MOTIVATION

The production of neutral vector mesons in nucleons and nuclei and the subsequent measurement of their decay into lepton pairs has the potential to provide interesting new information. In addition, the photon energy range proposed is in a region where shadowing is still an open question and precise data can contribute to our understanding of this problem. With considerably more simulation and theoretical analysis this experiment may provide information on the production, decay, and possibly the propagation of vector mesons in the nuclear medium.

ISSUES

The question of the impact of inherent asymmetries of CLAS for e^+-e^- measurements needs to be examined and modeled. The experiment should continue to be optimized, both as to the target position, with more accurate modeling of the production rate into this weak decay branch and by more thorough consideration of other background channels that may be present.

The proponents are encouraged to pursue theoretical support in the analysis of the production amplitudes, including the details of the interference of the decay leptons with the Bethe-Heitler pairs. The effect of the Coulomb field on the expected asymmetry of the pairs should be investigated.

The large amount of beam time required for a precise measurement and the non-standard experimental arrangement require careful optimization before a final decision can be made. In any case, the Committee recommends that the measurements on heavy targets await the analysis of the light target data.

The experiment is difficult and the proposal should be re-examined after some operating experience with the CLAS is available.

MANPOWER

Adequate.

RECOMMENDATION

Deferral.